



Interoffice Memorandum

Date: May 10, 2005

To: Bob Heitzman, Environmental Specialist 3, Standards and Technical Support Section, Division of Surface Water

From: Mylynda Shaskus, Environmental Specialist 2, Standards and Technical Support Section, Division of Surface Water

Subject: Information Regarding the Development of Human Health Water Quality Criteria for Mirex for the Ohio River Basin

Background

Ohio is divided into two major basins for the purpose of water quality standards: the Lake Erie Basin and the Ohio River Basin. The Lake Erie Basin human health water quality criteria (HHWQC) are currently developed using the Great Lakes Water Quality Initiative (GLI) methodology (USEPA 1995a). This guidance is the basis for Ohio Administrative Code rule 3745-1-38, which became effective in October 1997. However, this rule is not used for the purpose of calculating HHWQC for the Ohio River Basin. Therefore, a different approach is needed when calculating HHWQC for the Ohio River Basin.

Basis for the Ohio River Basin Human Health Water Quality Standard calculations

The document used as the basis for the Ohio River Basin HHWQC calculations is the *Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health* (USEPA 2000) and its associated support documents. The guidance in this document was used to calculate the mirex HHWQC for the Ohio River Basin, with the exception of incorporating a bioaccumulation factor (BAF) and separate consumption level for trophic level 2 fish. The justification for some of the chemical-specific inputs used in the calculations is given below, as is the rationale for not providing separate information for trophic level 2 fish.

Derivation of the cancer slope factor

At the time of these calculations, USEPA, through its Integrated Risk Information System (IRIS), does not list a cancer slope factor for mirex. However, permission was gained from USEPA to use a draft cancer slope factor for mirex as published by USEPA's research arm, National Center for Environmental Assessment (NCEA). This draft value is used in the mirex HHWQC calculations for the Ohio River Basin.

Derivation of the relative source contribution factor

The guidance given in the USEPA 2000 methodology was used to calculate a relative source contribution factor. Site-specific parameters generated as part of a risk assessment on Middle Fork Little Beaver Creek were used to derive the relative source contribution factor used in the HHWQS development. The specific details associated with those assumptions are included in the file for the mirex HHWQC.



Combining the fish intake of trophic level two and three fish

Consumption of trophic levels 2 and 3 fish were combined into trophic level 3 for the purposes of calculating the Ohio River Basin mirex HHWQC. The basis for this can be found in the document *Trophic Level and Exposure Analyses for Selected Piscivorous Birds and Mammals, Volume I: Analyses of Species in the Great Lakes Basin* (USEPA 1995b). The USEPA 2000 methodology references the 2000 version of the *Trophic Level* document as the basis for determining trophic levels for fish. The majority of fish consumed by humans given in that document have a trophic level range of 2.8-3.2. Almost no fish have a trophic level of less than 2.7. That fact, along with the dearth of available bioaccumulation factor information for trophic level 2 fish, is the reason that the consumption levels for trophic level 2 and 3 fish were combined in the HHWQS calculations. The effect of combining trophic levels 2 and 3 is to make the resulting HHWQS more conservative than keeping trophic level 2 separate from trophic level 3 in the calculations.

Other factors used in calculating the Ohio River Basin Human Health Water Quality Criteria for mirex

All other variables used in calculating the mirex HHWQS for the Ohio River Basin are default assumptions given in USEPA's 2000 Methodology, or are explained through the use of references on the criterion fact sheet. The factors described above are outside the scope of the 2000 Methodology, and therefore warranted further explanation.

If you have further questions, please let me know.

References

- USEPA. 1995a. Great Lakes Water Quality Initiative Criteria Documents for the Protection of Human Health. EPA-820-B-95-006. March 1995.
- USEPA. 1995b. Trophic Level and Exposure Analyses for Selected Piscivorous Birds and Mammals, Volume I: Analyses of Species in the Great Lakes Basin. Draft. March 1995.
- USEPA. 2000. Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health. EPA-822-B-00-004. October 2000.

Chemical Name: MirexDeveloped by: Mylynda Shaskus, Bob HeitzmanCAS # 2385-85-5IRIS Data Retrieval Date: 5-10-05

Internal Code # _____

Fact Sheet Preparation Date: 5-10-05

CRITERIA SUMMARY

Ohio River Basin			
Noncancer AWQC ($\mu\text{g/l}$)		Cancer AWQC ($\mu\text{g/l}$)	
Drinking	Nondrinking	Drinking	Nondrinking
0.0010	0.0010	0.00011	0.00011

EXPOSURE AND TOXICITY DATA

Human health trophic level 3 bioaccumulation factor ($\text{BAF}_{\text{TL2\&3}}$) = 353,400 l/kg (USEPA 1995)

Human health trophic level 4 bioaccumulation factor (BAF_{TL4}) = 1,461,000 l/kg (USEPA 1995)

Reference Dose (RfD) = $2.3\text{E-}4$ mg/kg/day (IRIS RfD, last revised 10/01/92)

Carcinogen assessment: Weight-of-Evidence Group B2, Likely to Be Carcinogenic to Humans (USEPA 1999)

Cancer slope factor (q_1^*) = 0.53 (mg/kg/day) $^{-1}$ (USEPA 1999)

Body weight of average human (BW) = 70 kg (USEPA 2000)

Relative source contribution factor (not used with linear carcinogenic slope factors) (RSC) = 0.8 (USEPA 2000, Environ 2004)

Drinking Water Intake (DI) = 2.0 l/day for drinking water criteria (USEPA 2000)

Fish intake (FI) = 0.0175 kg/day (default value for general population and sport anglers)

Fish intake of trophic level two and three fish ($\text{FI}_{\text{TL2\&3}}$) = 0.0118 kg/day (USEPA 2000)

Fish intake of trophic level four fish (FI_{TL4}) = 0.0057 kg/day (USEPA 2000)

Ambient Water Quality Criteria (AWQC) = $\mu\text{g/L}$

Risk Specific Dose (RSD) = $1\text{E-}5/q_1^*$ mg/kg-d

REFERENCES

Environ Inc. Endangerment Assessment Nease Chemical Company Salem, Ohio. April 2004.

Integrated Risk Information System. USEPA Office of Research and Development, National Center for Environmental Assessment. <http://www.epa.gov/iris/index.html>

Ohio Administrative Code rule 3745-1-38: Methodologies for Development of Human Health Criteria and Values for the Lake Erie Drainage Basin. Effective 10/31/97.

USEPA. 1995. Great Lakes Water Quality Initiative Technical Support Document for the Procedure to Determine Bioaccumulation Factors. EPA-820-B-95-005. March 1995. p. H-3.

USEPA. 1999. Risk assessment issue review: Characterizing cancer risk from exposure to mirex at the Nease Chemical Site near Salem, Ohio. 98-011/1-28-99. Attachment to letter from U.S. EPA Region 5 to Dr. Rainer Domalski, Ruetgers Organics Corporation. February 9.

USEPA. 2000. Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health. EPA-822-B-00-004. October 2000.

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CALCULATION OF NONCARCINOGENIC AMBIENT WATER QUALITY STANDARD

$$AWQC = RfD \times RSC \times \left(\frac{BW}{DI + \sum_{i=2}^4 (FI_i \times BAF_i)} \right)$$

For consumption of water and organisms:

$$AWQC[\mu g / L] = RfD \times RSC \times \left(\frac{BW}{DI + (FI_{TL2\&3} \times BAF_{TL2\&3}) + (FI_{TL4} \times BAF_{TL4})} \right) \times 1000 \mu g / mg$$

$$= 2.3E-4 [mg / kg - d] \times 0.8 \times \left(\frac{70kg}{2L / d + (0.0118kg / d \times 353,400 [L / kg]) + (0.0057kg / d \times 1,461,000 [L / kg])} \right) \times 1000 \mu g / mg$$

$$= 0.0010 \mu g / L$$

For consumption of organisms only:

$$AWQC[\mu g / L] = RfD \times RSC \times \left(\frac{BW}{(FI_{TL2\&3} \times BAF_{TL2\&3}) + (FI_{TL4} \times BAF_{TL4})} \right) \times 1000 \mu g / mg$$

$$= 2.3E-4 [mg / kg - d] \times 0.8 \times \left(\frac{70kg}{(0.0118kg / d \times 353,400 [L / kg]) + (0.0057kg / d \times 1,461,000 [L / kg])} \right) \times 1000 \mu g / kg$$

$$= 0.0010 \mu g / L$$

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CALCULATION OF CARCINOGENIC AMBIENT WATER QUALITY CRITERION

$$AWQC = RSD \times \left(\frac{BW}{DI + \sum_{i=2}^4 (FI_i \times BAF_i)} \right)$$

For consumption of water and organisms:

$$\begin{aligned} AWQC[\mu g / L] &= \frac{RSD \times BW \times 1000 \mu g / mg}{2L / d + (FI_{TL2\&3} \times BAF_{TL2\&3}) + (FI_{TL4} \times BAF_{TL4})} \\ &= \frac{(1E - 5 / 0.53) mg / kg - d \times 70 kg \times 1000 \mu g / mg}{2L / d + (0.0118 kg / d \times 353,400 [L / kg]) + (0.0057 kg / d \times 1,461,000 [L / kg])} \\ &= 0.00011 \mu g / L \end{aligned}$$

For consumption of organisms only:

$$\begin{aligned} AWQC[\mu g / L] &= \frac{RSD \times BW \times 1000 \mu g / mg}{(FI_{TL2\&3} \times BAF_{TL2\&3}) + (FI_{TL4} \times BAF_{TL4})} \\ &= \frac{(10^{-5} / 0.53) mg / kg - d \times 70 kg \times 1000 \mu g / mg}{(0.0118 kg / d \times 353,400 [L / kg]) + (0.0057 kg / d \times 1,461,000 [L / kg])} \\ &= 0.00011 \mu g / L \end{aligned}$$